The 90-year-old Model A engine is usually seen dragging a Pietenpol around (Dan Helsper's award-winner), but other designs used it, too. The Burtz Model A block brings new-age technology to the old war horse.

A Modern Model A Motor

Back to the future

BY BUDD DAVISSON

BEFORE WE JUMP INTO techno talk, I have a couple of caveats right upfront. First, I realize that this discussion is going to be of interest to about 19 (maybe 20) people reading this. It's pretty esoteric. Second, just so everyone knows going into this conversation, the engine being discussed, a brand-new version of the 1928-1931 Model A Ford four-banger, is 35-40 pounds heavier than the original, which would require a little redesigning for existing airframes like the Pietenpol. In general, we all hate weight. But there are some good reasons for that extra weight in the Burtz block, all of them contributing to the strength and reliability of it as an aero engine.

So, why are we talking about an ancient, water-cooled auto engine for airplanes? We're discussing this upgrade because there are a few airplanes out there that were designed for Ford Model T/A/B engines (Pietenpol, Gere Sport biplane, Corben Super Ace, etc.), and this is a worthwhile and unexpected development for those airplanes. Or, if you want something really different, you could use it to power a 1946 Funk Model B (in the experimental-exhibition category). Originally, those came out with the Funk Model E engine, which was a slightly modified Ford B series engine, which, in turn, was a modified Model A engine. Got all that? More modern aircraft might have been designed for that engine, but these days the concept of starting off with a 90-year-old engine block doesn't appeal to many builders.

Why am I so pumped up on the Burtz Model A block? Part of it is because its new block and five-main journals, balanced crankshaft (the stock crank has three mains), and balanced rods cost $3,950. In airplane terms, that's close to being cheap. It would cost nearly that much to have an ancient block built up to the same specs — but even though rebuilt, it's still pushing the 100-year mark. When all the rest of the needed parts and the hop-up goodies are installed, you'll have less than $8,000 tied up in it. Sad to say, these days, that's a reasonable number (don't forget the radiator).

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The Burtz block is completely reengineered to give a totally pressurized oil system, 2-inch crank and rod bearings, bigger valves, hardened valve seats, and everything else expected of a new millennium engine. It looks old on purpose.

What do you have when you start with this 201-cubic-inch, 40-hp engine and then fix all of its old-time mechanical foibles and start pushing it for power? As it happens, the ground-bound Model A community has made it their mission to get as much dependable horsepower out of it as they can. There are lots of hop-up parts (cams, high-compression heads, carburetion, etc.) that easily push the horsepower up to 100-110. This includes the aluminum Rocket 428 high-compression head (6.5-to-1 compression ratio) that has two plugs per cylinder (available through SecretsOfSpeed.com). In addition to increased efficiency, cooling, and power, this head solves some of the ignition problems unique to airplanes.

The usual ignition for a Model A on the ground is a normal battery distributor mounted through the head. Most of the engines being flown have an aircraft magneto mounted in a handmade rack on the back driven by a belt from the crank pulley. The design for that is simple and readily available in Pietenpol literature. Or, better yet, a little time can be spent haunting eBay looking for the fairly available WICO magnetos that drop right into the battery distributor hole. (Model VX 1509 is best, but Model JEM 1509 also works.) Using the Rocket 428 head and the rear-mounted magneto would give you two mags and two plugs per hole, just like a real airplane engine.

EA HBW 2201

5.278 x 9.778

The dynamically balanced crankshaft is installed. It has five journals (as opposed to the original three) and full insert bearings rather than Babbitt bearings so it is a far cry from the original.

The forged rods come with the 2-inch main inserts and wrist pin bushings already installed.

For aircraft use, the rear main bearing, which is in front on an airplane, is easily reassembled to be pulled on rather than pushed, as it is in a car.

When talking about power potential, don't forget that until the high-revving Offenhauser double-overhead cam four-banger came along in the mid- to late-1930s, the Model A four-banger and the similar 1932 Model B were the engines to beat on America's dirt tracks. These engines actually held their own long after the V-8 came out. This was partially because of its torque curve, which definitely works to its advantage as a funky airplane engine.

Let's go back to basics. As everyone (I think) knows, the reason automotive engines usually need a crankshaft reduction unit to work in airplanes is because most auto engines don't deliver their maximum hp/torque until they are turning 3500-4000 rpm or higher. So, because prop tips have to be kept subsonic (Mach .9 or so) unless they are geared down, the props are turning too fast and have to be tiny. Flat airplane engines get their hp around 2700 rpm because that lets them swing normal diameter props without the tips going too fast. The torque curves of both engine types show that they need the rpm to give the torque. However, the torque curves on Model A/B engines peak out at 1700-1800 rpm. This means they can swing enormous (by modern standards) propellers. Aerodynamically speaking, slower, bigger props put the horsepower to work better than shorter, higher rpm ones. Besides, nothing is prettier than a nicely finished, laminated wood prop.

So, what about the Burtz engine makes it so much more special than a stock Model A? The answer is just about everything. For instance, Model A's had Babbitt main bearings, which are essentially poured metal that is align-bored to cradle the crankshaft. These are not long-lived bearings, and they don't take well to higher compression. Most builders do the machine work to replace them with insert bearings. The stock Model A compression ratio is 4.2-to-1, and we want 6.5 or higher. Much worse, the bearings aren't pressure oiled. In a stock "A" engine, the rod caps have dippers that scoop oil and splatter it around, and the three main bearings are gravity fed. Then, on top of that, the crankshaft thrust bearing depends on mist oiling. The new Burtz block and crankshaft supply pressurized oil to all 16 bearings, including the rear crankshaft thrust bearing. For use in an airplane, it is easy to divert pressurized oil to the forward thrust bearing that is continuously loaded during flight.

Terry Burtz, a retired senior staff engineer from Lockheed, and John Lampl, a longtime manufacturing manager with background in manufacturing new blocks for CJ2 Jeeps, did not set out to design and produce a new antique engine to be used in antique-like amateur-built aircraft. In fact, they expressly say they do not — in any way, shape, or form — endorse the use of their engine in aircraft. Every single one of their engines sold has that statement clearly stated in the purchase agreement. What they started out to do, and have done, is cater to the ever-present Model A Ford driver's market. About 5 million Model As were built from 1928 to 1931. It has been estimated that about 200,000 Model As are still running around. A surprising number of them are driven shockingly long distances on a regular basis. That represents a viable and enthusiastic market for the Burtz block. Its website summarizes the engine as follows:

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A number of aluminum, high-compression heads are available from various sources. The 6.5-to-1 compression ratio, two-plug-per-cylinder Rocket 428 head, shown here with the optional racing cooling tube, is available from SecretsOfSpeed.com.

***The Burtz Model A Engine Kit** is a newly engineered and manufactured kit of parts designed to replace the frail original Ford Model A engine components that will break if driven hard.*

The new Block, Crankshaft, and Connecting Rods are re-engineered for strength and durability and manufactured in a modern factory that supplies OEM engine parts to many manufacturers. The kit's external appearance once installed is identical in appearance to the original Model A Engine. All new machined interfaces for attaching parts are a match to original interfaces.

... The block comes ready for assembly with no machining required. All parts needed to assemble an engine other than the crankshaft and connecting rods are standard Model A engine parts, or they may be purchased from an auto parts store.

Cylinder Block

The new Block is cast and machined from modern high-strength grey cast iron. The new block features larger, streamlined intake ports and an internal, closed pressurized oil lubrication system that feeds oil directly to main journals, connecting rods, rear main thrust bearing, camshaft bearing journals, and the camshaft thrust bearing. All oil passages are drilled through solid cast iron. The block has replaceable cam bearings fitted for use with either a three or five bearing camshaft and hard exhaust valve seats. The rear crankshaft seal is a standard "off the shelf" radial lip seal.

Crankshaft

The new crankshaft is made from nodular iron and has eight counterweights with five 2" main journals where the Model A had 1.5-inch journals. All bearing fillets are rolled and the surface of the journals is hardened. The crankshaft is cross-drilled to lubricate the connecting rod journals, and dynamically balanced. The front and rear interface surfaces accept the standard timing gear, front pulley, and flywheel original to the Model A engine. The main and connecting rod journals both utilize the same standard 2" insert bearings that were used in GM engines from 1955 until 2003 (Federal Mogul 2020 CP).

Connecting Rods

The new connecting rods are forged steel and utilize 2-inch insert bearings for the crankshaft journal. Wrist pin bushings are installed and ready for assembly with standard Model A type pistons. The connecting rods are balanced in sets of four to closer than Ford tolerances. The rod caps are bolted in place with high-strength 3/8-24 UNF 12-point bolts.

Bernard Pietenpol designed a super-simple DIY magneto mount to be hung on the front (aircraft rear) of the engine and is belt driven from the crank pulley.

Old WICO mags that drop right in the original distributor hole in the head can be found on eBay and paired with a rear-mounted mag to give dual mags. The Secrets of Speed front (rear on aircraft) ignition drive mounts VW distributors or magnetos.

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As part of the support info for the new Burtz engine, Terry generated complete assembly manuals available at ModelAEngine.com and BurtzBlock.com. They give extra details on the engines.

The first run of 90 blocks was sold immediately, and their test engine was run at 3100 rpm (normal redline is around 2700 rpm) for six hours straight. Another took a 7,000-mile jaunt across the country and back with zero problems. At 50 mph — a reasonable Model A cruising speed — that's 140 hours of on-the-road test time!

Given that this is a new engine, it would be fun to design a new airplane around it — sort of a new-age anachronistic something or other. I leave that to your imagination.

Here are some weight comparisons for Model A engines versus the rest of the world. *EAA*

	HP	BLOCK, POUNDS	IN AIRCRAFT, POUNDS
Model A, Short Block	40-110	152	
Burtz, Short Block	40-110	196	316 (with prop, water, oil, radiator)
Model A	40-110		272 (with prop, water, oil, radiator)
Continental O-200A	100	216	247 (with prop, oil)
Corvair	95-110	220	245 (with prop)

Budd Davisson, EAA 22483, is an aeronautical engineer, has flown more than 300 different types, and has published four books and more than 4,000 articles. He is also a flight instructor primarily in Pitts/tailwheel aircraft. Visit him on AirBum.com.

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